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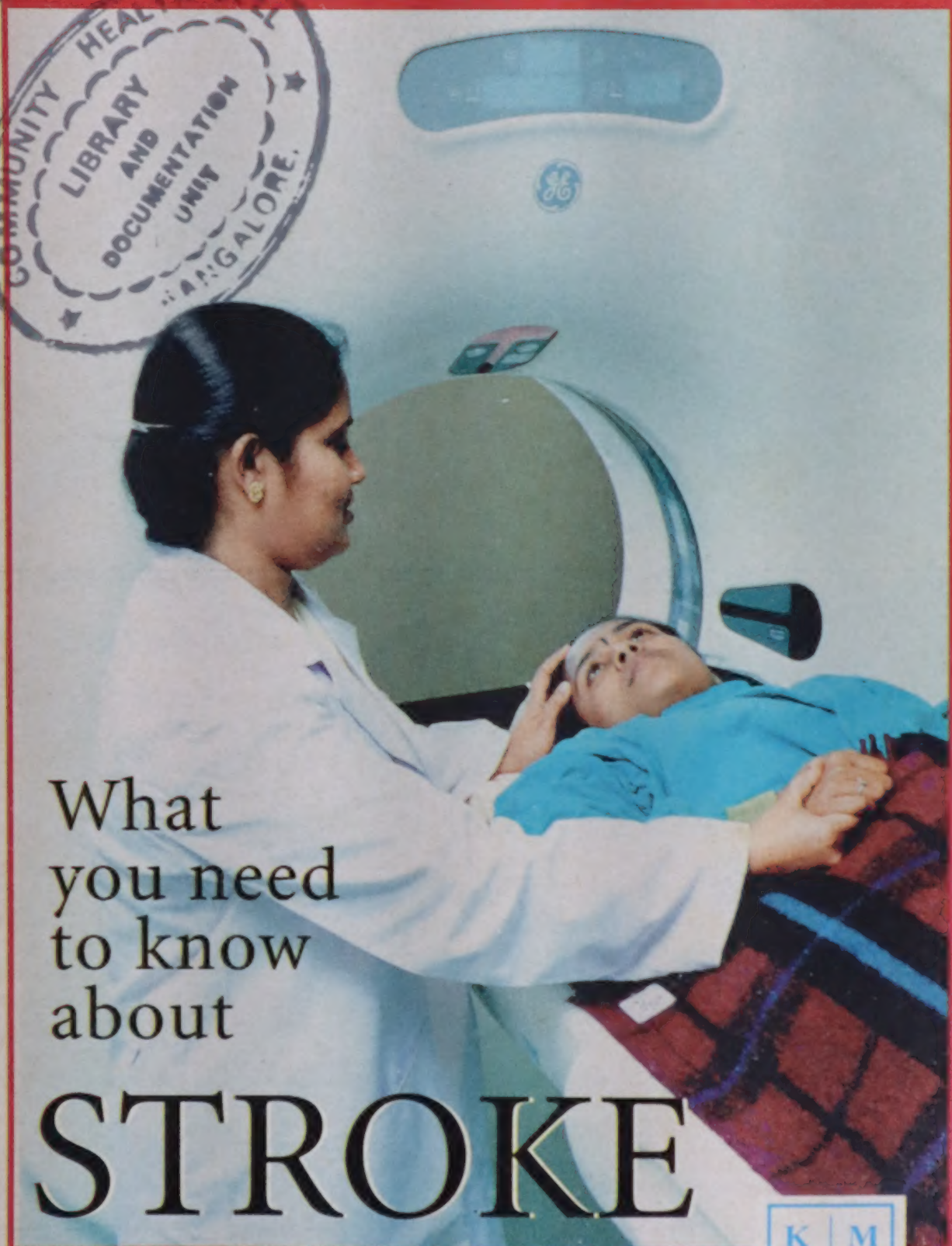

What you need to know about STROKE

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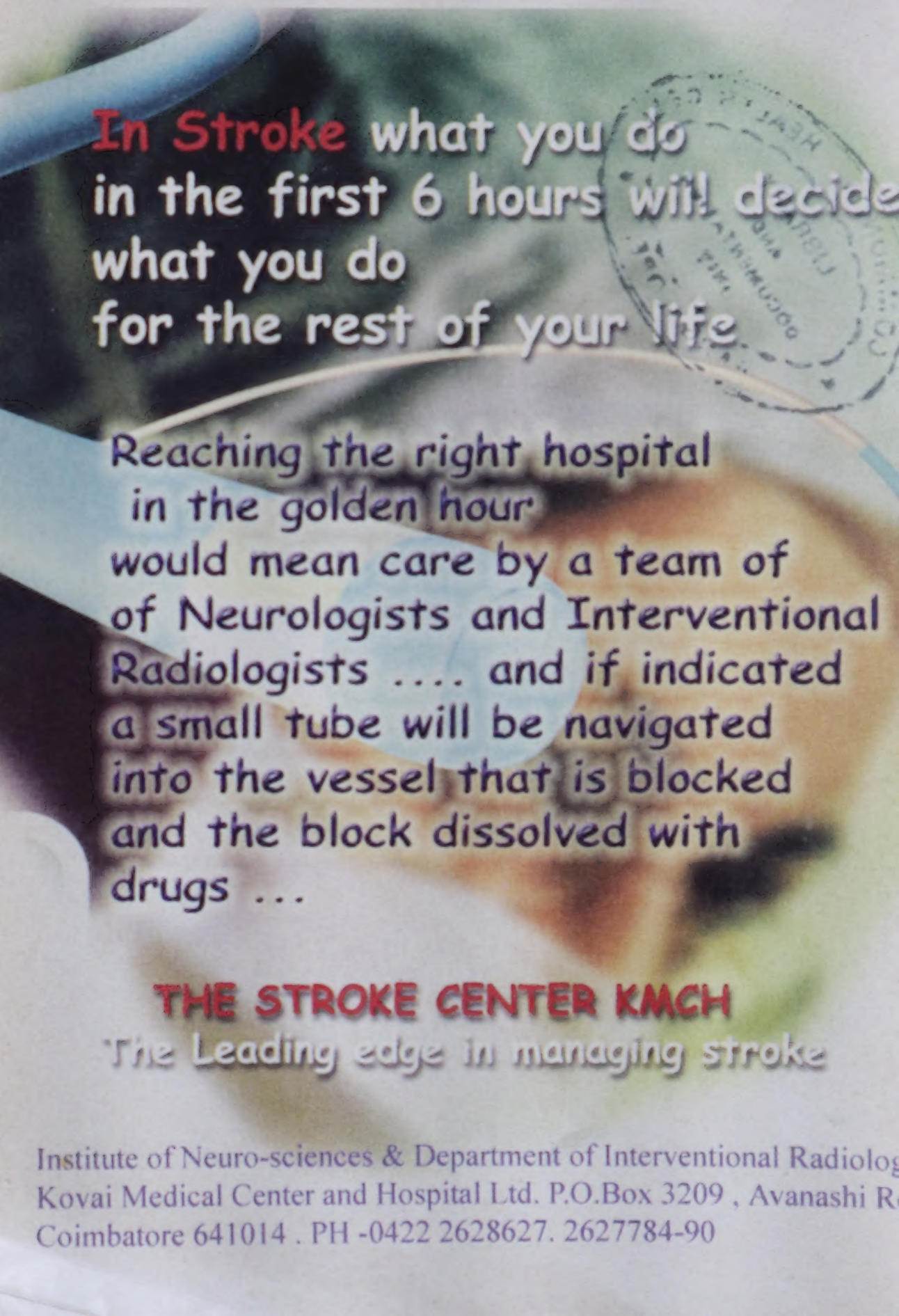
In Stroke what you do
in the first 6 hours will decide
what you do
for the rest of your life
Reaching the right hospital
in the golden hour
would mean care by a team of
of Neurologists and Interventional
Radiologists .... and if indicated
a small tube will be navigated
into the vessel that is blocked
and the block dissolved with
drugs ...
THE STROKE CENTER KMCH
The Leading edge in managing stroke

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◆ Do you know anyone who has suffered a stroke?

◆ Do you know that stroke is a cause of sudden death?

◆ Do you know that stroke can be treated?

◆ Do you know that stroke can be prevented?

◆ Do you know that stroke affects the young?

If the answer to any one of the above questions is NO, you must read on...

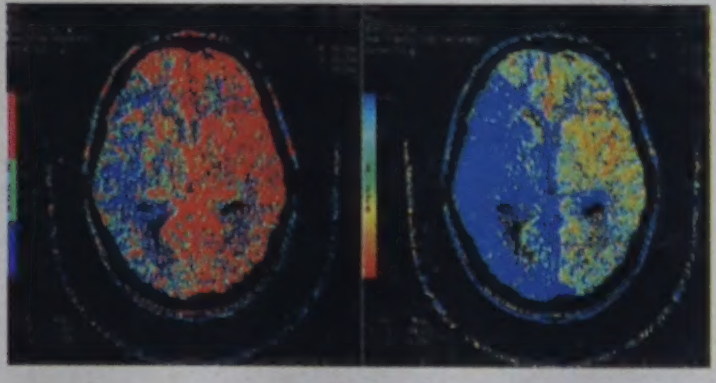
Cerebrovascular disease

Cerebrovascular disease is one of the most devastating, and misunderstood, epidemics of our time. The word 'cerebrovascular' is made up of two parts: 'cerebro' means the brain and 'vascular' means arteries and veins. The term cerebrovascular disease includes diseases of the brain and vascular structure and covers acute stroke and other diseases that may lead to stroke, like carotid stenosis or aneurysms.

Stroke is the third largest killer after heart diseases and cancer. The prevalence of stroke in India is up to 268 per 100,000 population. In developed countries it is almost four times the Indian figure. The cornerstone of stroke management in India is primary and secondary prevention, good medical care, nursing and early rehabilitation.

Stroke and brain

Despite being only about 2 per cent of your total body weight, your brain continuously



Stroke is the thrid largest killer after heart diseases and cancer.

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Stroke—an enigma

- Stroke is common in people who have: Diabetes; Hypertension (high blood pressure)
- Stroke is more common in patients with heart diseases (coronary artery diseases)
- Stroke can run in the family
- Stroke is a cause of sudden death

Cigarette smoking, obesity and high cholestrol levels predispose a person to stroke

- If treated in time patients of stroke can recover completely and can resume their normal activities

'Brain Attack' is another name of stroke. Heart attack is a commonly used term for the spectrum of symptoms seen after blood supply to the heart decreases.

receives about 20 per cent of the blood that flows through your body. Your brain controls every action of your body from walking and talking to moving your arm and breathing. For proper functioning, it requires constant supply of energy through blood.

Stroke occurs when blood flow to the brain is somehow disrupted and brain cells lose their supply of nutrients. This happens when the brain receives too little, or too much blood. If this problem is not fixed within hours, brain cells die causing permanent brain damage. Once brain cells die, they cannot be regrown or revitalised.

There are two types of stroke—Ischaemic stroke and Haemorrhagic stroke. Ischaemic stroke is more common and occurs when blood flow to the brain is blocked. Haemorrhagic stroke is less common but more deadly and occurs when there is bleeding into or around the brain itself. It includes both intracerebral haemorrhage and subarachnoid haemorrhage. Ischaemic strokes, which in-

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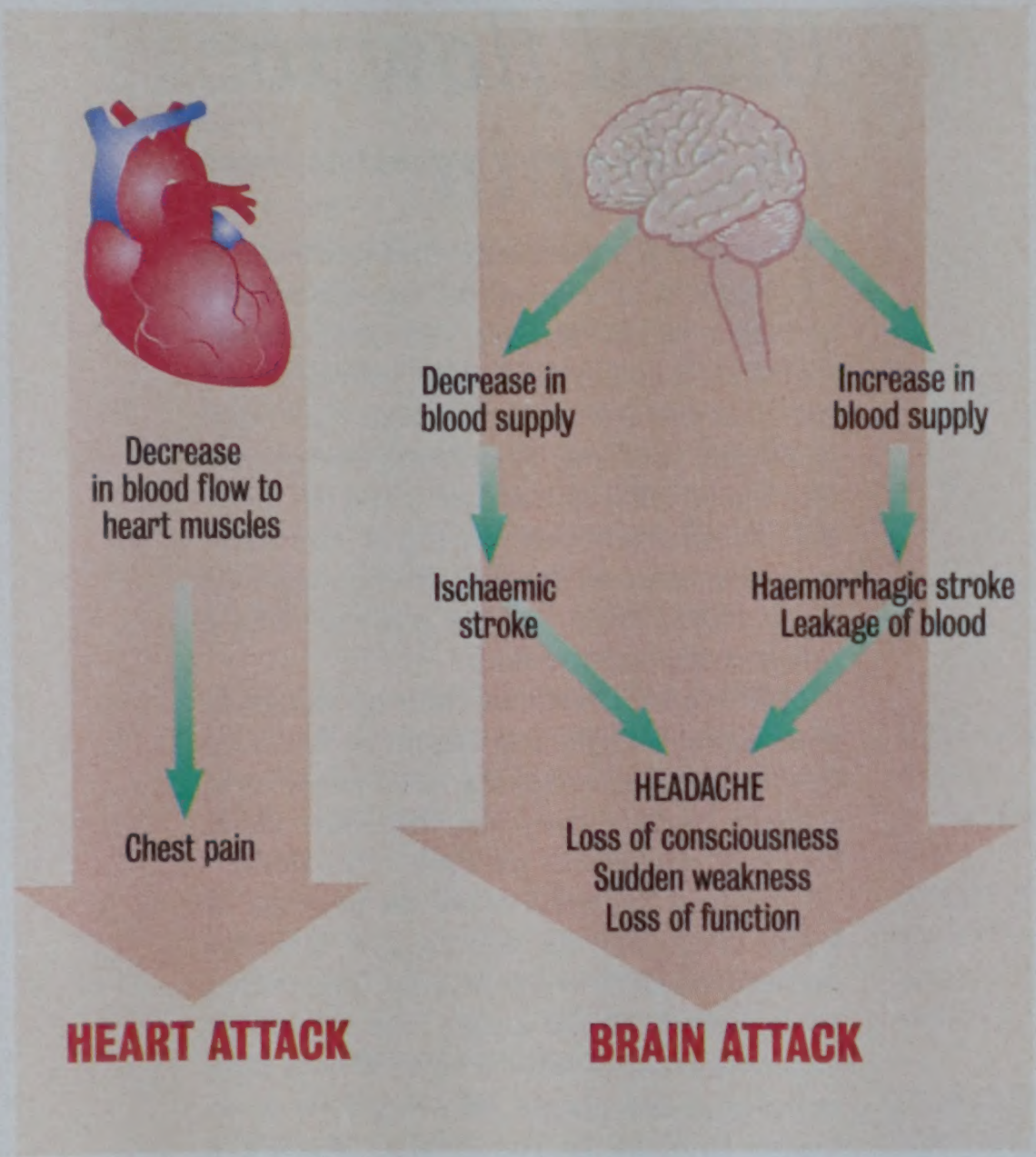

clude thrombotic and embolic stroke account for 84 per cent of all stroke cases. Haemorrhagic stroke accounts for 16 per cent of all strokes including sub-arachnoid haemorrhage. Further discussion will explain the causes, diagnosis and treatment of different types of stroke.

Blood flow to the brain

The heart pumps blood to the brain through two sets of arteries, the carotid arteries and the vertebral arteries. The carotid arteries can be found in the front of your neck and are what you feel when you take your pulse just under your jaw. The carotid artery splits into the external carotid artery and the internal carotid artery near the top of your neck, with the external carotid artery supplying blood to your face and the internal carotid artery going into the skull.

The vertebral arteries come up alongside your spinal column and cannot be felt from the outside. The vertebral arteries join to form a single basilar artery near the brain stem, which is located near the base of the skull.

Because the brain relies on two sets of major arteries for its blood supply, it is very important that these are healthy. Often when an ischaemic stroke occurs, the carotid or vertebral artery system is blocked with fatty build-up called plaque, allowing little or no blood to flow to the brain. During a haemorrhagic stroke, an artery in or on the surface of the brain has ruptured or is leaking, causing bleeding and damage in or around the brain.

Often in an ischaemic stroke, the carotid or vertebral artery system is blocked with fatty build-up.

The majority of cerebrovascular problems are identified through diagnostic imaging tests. These tests allow neurosurgeons/neuroradiologists/interventional

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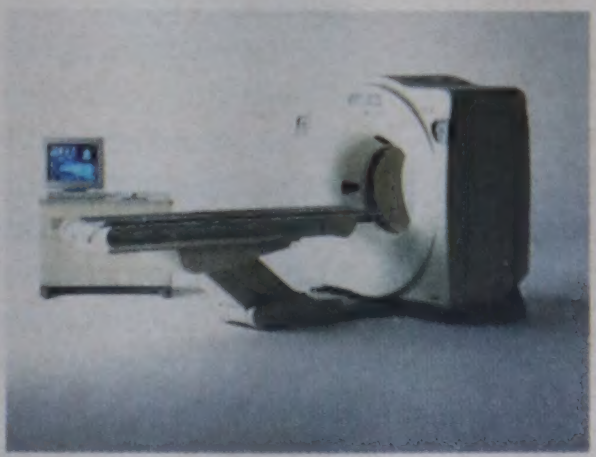
neuroradiologists to get an inside look at the arteries in and around the brain and the brain tissue.

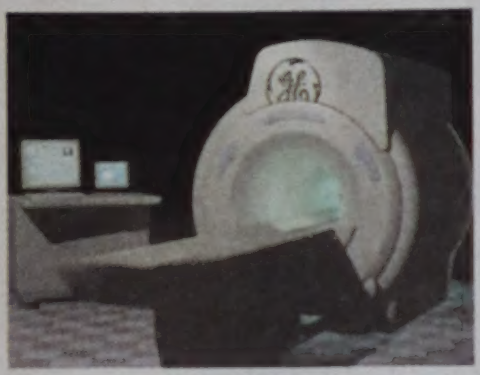
Doppler ultrasound: This is the most basic imaging test of the carotid arteries. It is non-invasive and takes some 20 minutes. Using an ultrasound machine, sound waves are reflected from the structures in the neck and reconstructed into a picture of the outside and inside of the artery walls. It can also use changes in the reflected sound waves to determine the level of blood flow through the artery. The Doppler ultrasound usually can only visualise arteries in the neck.

CT scan: The Computed Tomographic Scan (also called a CT or CAT scan) uses an X-ray beam and a computer to generate an image of the head. Sometimes a medication will be injected through a vein to help highlight the brain structures. The CT images are a representation of different densities. Bone, blood and brain tissue have very different densities and can easily be distinguished. Even different areas within the brain have different densities and can be seen. Previous strokes can be seen on this type of scan.

The CT scan uses an X-ray beam and a computer to generate an image of the head.

A CT scan is essential for diagnosing haemorrhagic stroke because blood can be easily seen. However, damage from an ischaemic stroke may not be revealed on a CT scan for several hours or days and the indi-





MRI uses a large magnet and radio waves to visualise flow of blood in vessels of the neck and brain.

vidual arteries in the brain cannot be seen.

MRI/MRA: Magnetic Resonance Imaging (MRI) and Magnetic Resonance Angiogram (MRA) use a large magnet and radio waves to generate an image of the head, or to visualise flow within the blood vessels of the neck and brain. The arteries in the neck, the major arteries inside the head and the brain tissue itself can be seen. An MRI of the brain can help determine whether there is a sign of previous 'mini' strokes. The MRA shows the actual blood vessels in the neck and brain and can help detect blockage or any abnormal vessel(s) or blister on a vessel. An MRI/MRA is a non-invasive procedure and takes around 30 minutes.

Angiography: Golden standard

During an angiography, X-rays take a picture even as medicine is injected directly into the artery. The resulting angiogram is the most accurate way of looking at arteries in the neck, head and brain, and provides information that cannot be obtained with other tests. It is often used to determine the amount of blockage in the artery in the neck. It is also used to detect the location and size of aneurysms and vascular malformations. This is an invasive test, requiring a physician to insert a catheter (a small tube) into the major artery near the groin and direct it 'upstream' to arteries near the brain.

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Risk factors

The best treatment for ischaemic stroke is to prevent a major cerebrovascular event from occuring. The non-modifiable risk factors include race, age and sex. The modifiable risk factors include the following:

Hypertension: High blood pressure is the leading cause of both ischaemic and haemorrhagic strokes. High blood pressure should be treated to keep it below 140/90mm/Hg. Both the upper and lower numbers are important. The faithful following of a blood pressure treatment plan can help prevent a stroke.

Cigarettes: Smoking doubles your chances of suffering a stroke.

SIVARAM V.

Smoking, high blood pressure and obesity are modifiable risk factors.

Weight: Obesity increases your chance of suffering hypertension and high blood cholesterol, a risk factor for carotid stenosis. Even modest weight gain (10 to 20 pounds over 16 years) can almost double your chances of suffering a stroke.

Carotid stenosis: The build-up of fatty plaque on the inside of the carotid artery increases

your chances of suffering an ischaemic stroke.

Cholesterol/serum lipid levels: High cholesterol levels can promote carotid artery stenosis and lead to stroke. A healthy diet and medications prescribed by your primary care physician can help reduce cholesterol levels to below 200.

Besides these factors, ischaemic heart diseases, coronary artery diseases and diabetes also increase the chances of stroke.

Making lifestyle changes and following treatment plans prescribed by your primary care physician can decrease your chances of suffering a stroke more than tenfold.

Warning signs

There are also 'warning signs' of an impending ischaemic stroke, and it often does not strike unannounced.

Prior stroke: Stroke can strike a person many times. Suffering one stroke, regardless of its severity increases your chances of suffering a second stroke.

TIA (Transient Ischaemic Attack): A TIA is a temporary cerebrovascular disruption that causes no permanent damage. These are recognisable events and can be a predictor of a future, more devastating stroke.

Warning signs of haemorrhagic stroke include:

Headache: A severe, sudden, unusual headache can be a sign of a haemorrhagic stroke and requires immediate medical attention.

Although neurologists, neurosurgeons and interventionalists treat all types of acute stroke, there are four risk factors, warning signs and conditions that are best recognised and treated by a neurosurgeon before acute stroke occurs: TIAs, carotid stenosis, aneu-

Suffering one stroke, regardless of its severity, increases your chances of suffering a second one.

rysms, malformations.

Transient ischaemic attack

A TIA is a temporary cerebrovascular event that causes no permanent damage. An artery to the brain becomes blocked, causing stroke like symptoms, but the blockage is dislodged before any permanent damage is done. It is very important that TIAs are recognised and treated, and they should be viewed as an opportunity for medical professionals to intercede and prevent a major stroke. If you experience TIA symptoms, seek emergency medical help and notify your primary care physician immediately. Approximately 30 per cent of all people who suffer a major stroke experience a prior TIA and 10 per cent of all TIA victims suffer a stoke within two weeks. The sooner you seek medical attention, the sooner it can be diagnosed and treatment started.

You can prevent a stroke if you pay heed to the warnings immediately.

Sometimes symptoms of TIA are quite vague and difficult to recognise. TIAs can be caused by blockage in the major arteries supplying blood to the brain, the blockage of a small artery in the brain or because of a car-

Watch out for TIA

Symptoms of TIA are quite brief and usually last up to 30 minutes. They include:

- Visual disturbances, including sudden loss of functioning or loss of vision in one eye, blurry vision or 'graying'
- Weakness, numbness or clumsiness in one arm or hand
- Language problems, including slurred speech
- Facial droop/weakness
- Unusual dizziness, vertigo and overall numbness may also indicate a vertebrobasilar TIA and should be reported to your physician immediately.

diac problem. Diagnostic imaging test can help determine the cause of a TIA.

While there is no treatment for TIA itself, it is essential that its source be discovered and appropriately treated before another occurs. Treatment options for TIA patients focus on treating carotid artery disease (please see following section) or treating cardiac problems.

If you suffer a TIA you are at a higher risk for suffering a major stroke and should understand the signs and symptoms of stroke in order to act quickly. Early recognition and fast treatment are essential to effectively treating stroke. The treatment of TIA could be medical or surgical. Medical treatment includes anti-platelet agents and anti-coagulants.The surgical elements include the treatment of carotid artery diseases by the surgical or interventional procedures.

Carotid stenosis

Carotid artery disease refers to plaque building up on the artery wall. The body's natural reaction is to heal over it, much like a scab forming over a cut. This condition is called atherosclerosis—artheroma is the plaque material that builds up, and sclerosis refers to the body's reaction to harden the material. The material accumulates and narrows the artery. The narrowing is referred to as stenosis, which is measured in percentage of the diameter of the artery blocked (70 per cent stenosis means that the artery is 70 per cent blocked).

A carotid bruit—sound of blood flowing past a blockage—is an early warning sign of stenosis.

Your physician can detect early warning signs of stenosis during a regular physical exam from the presence of a carotid bruit. Carotid bruit is the sound produced when

blood flows past the blockage. A physician listening to the artery with a stethoscope can hear the turbulence caused by the disturbed flow.

If you are experiencing symptoms because of the stenosis, you are considered 'symptomatic'. There are several diagnostic studies that can determine if you have a stenosis and to what degree. You may also have a very significant stenosis, but not have any symptoms and, therefore, be considered 'asymptomatic'. Patients with any level of stenosis should be monitored on a regular basis so that changes in the degree of stenosis, regardless of treatment plan, can be noted and treated appropriately.

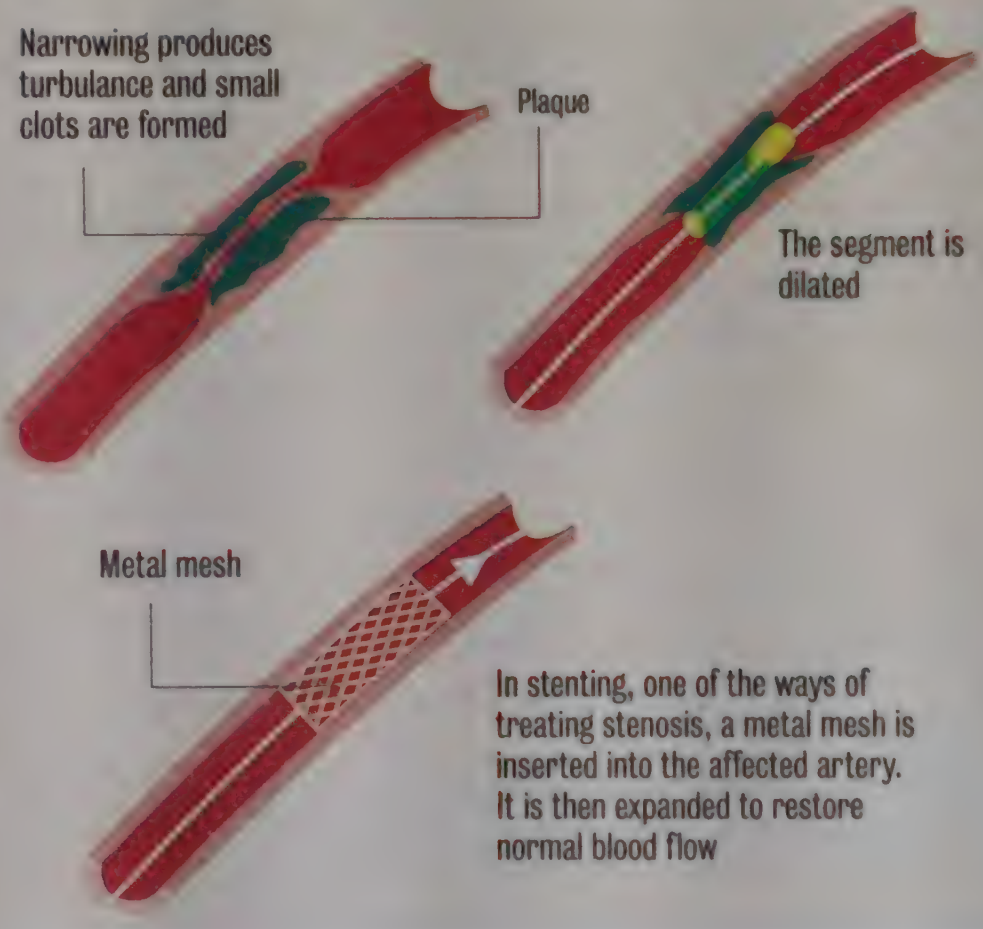
For patients with less than 50 per cent stenosis, medical therapy is often prescribed. There are anticoagulant drugs ('blood thinners') that interfere with the formation of blood clots. These include heparin and coumadin (also called warfarin). There are also medications that interfere with cell fragments called platelets that are involved in blood clotting. Drugs that interfere with platelet function (antiplatelet drugs) include Aspirin, Ticlopidine and Plavix.

Patients with more than 50 per cent stenosis can reduce their risk of stroke with minimally invasive endovascular therapy.

Patients with more than 50 per cent stenosis can often best reduce their risk of stroke with surgical therapy or by a minimally invasive endovascular therapy (angioplasty and stenting). Definitive treatment is aimed at restoring the luminal size of the diseased artery to near normal. The plaque build-up in the artery can be removed in a surgical procedure called endarterectomy. During carotid endarterectomy, the neurosurgeon exposes

Stenting

Carotid artery disease is caused by plaque building up on the artery walls. The narrowing of the artery is called stenosis


Narrowing produces turbulance and small clots are formed
Plaque
The segment is dilated
Metal mesh
In stenting, one of the ways of treating stenosis, a metal mesh is inserted into the affected artery. It is then expanded to restore normal blood flow

and opens the carotid artery, removes the plaque and closes the artery. The patient may have to be hospitalised for about 48 hours after the procedure. Complication rates for carotid endarterectomy are around 3 per cent, but individual risks should always be discussed with the surgeon before the procedure.

Certain features of stenosis, such as the size of the artery and location of the blockage, or certain medical conditions in the patient's history may call for a different treatment called carotid stenting. In this procedure, a small tube-like support called stent is threaded into the narrowing artery through a hole made in the groin (in the same way the angiography catheter is inserted). The stent is then expanded and opens the narrowing, restoring normal blood supply to the brain.

Aneurysm

An aneurysm is a thin-walled dilation of an artery. They typically develop where an artery branches and the wall is inherently weak. The aneurysm starts as a small bubble or enlargement, but can grow to several centimetres in diameter. Aneurysms commonly occur off the branches of the internal carotid artery, along the upper branches of the basilar artery and near the junction of the anterior cerebral arteries.

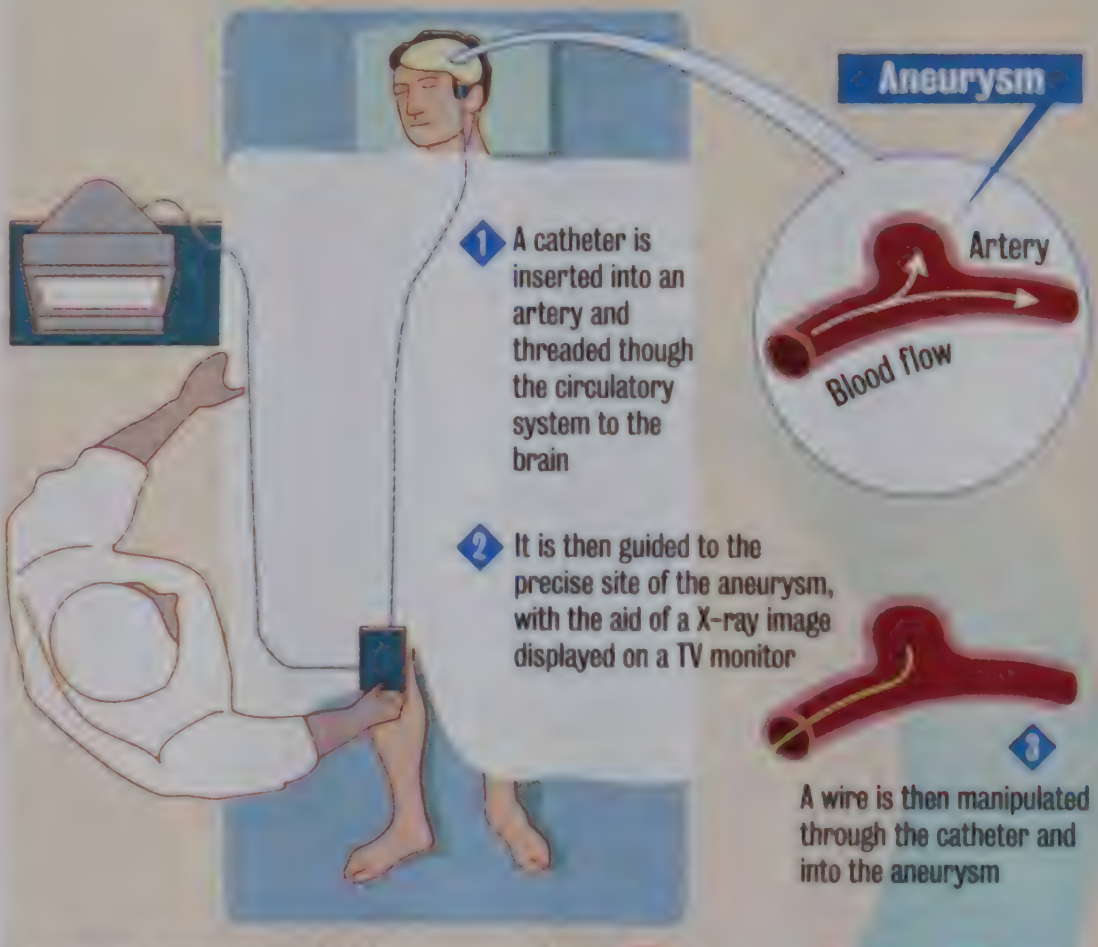
Aneurysms could leak or rupture. If blood is released into the cerebrospinal fluid space that surround the brain (the subarachnoid space) a subarachnoid haemorrhage (SAH) occurs. If the rupture of the aneurysm directs a jet of blood into the brain tissue, a blood clot forms within the brain and this is called intracerebral haemorrhage (ICH).

Aneurysm starts as a small bubble or enlargement, but can grow to several centimetres in diameter.

Around 30 per cent of all people who suffer SAH die before even reaching a hospital. Of those treated, only 60 per cent recover fully, the rest are disabled or die of the complications caused by the bleeding. Because of these devastating facts, it is often beneficial to

New treatment for aneurysm

An aneurysm is an abnormal bulging of the artery wall. This usually happens at points where the arterial wall is weak. A ruptured aneurysm could lead to a haemorrhagic stroke. Given below is a new treatment that reduces the patient's chances of suffering a stroke



1. A catheter is inserted into an artery and threaded though the circulatory system to the brain

2. It is then guided to the precise site of the aneurysm, with the aid of a X-ray image displayed on a TV monitor

3. A wire is then manipulated through the catheter and into the aneurysm

4. The coil's memory forces it to spring out as it enters the aneurysm cavity

5. Once the cavity is filled with the coil, a small electric current is applied to detach the coil from the rest of the wire

6. After the procedure, the body's main defences sense the coil as a foreign object and form a blood clot around it, reinforcing the area and lessening the likelihood of the artery bursting

discover and treat aneurysms before they rupture.

Aneurysms are normally diagnosed through a catheter angiography. A CT scan is used to show if a subarachnoid haemorrhage has occurred in the brain. Sometimes, bleeding in the brain is minimal and will not show up on the CT scan. A spinal tap, or a lumbar puncture, can be used to verify if there is any blood in the cerebrospinal fluid.

Some aneurysms are incidentally discovered, perhaps during an angiogram for carotid artery disease, and have not produced any symptoms or problems. In other cases, as the aneurysm grows, it compresses surrounding nerves and brain structures and causes symptoms including blurred vision, double vision or headache. Regardless of the size of the aneurysm or whether the aneurysm is producing symptoms, the condition needs prompt evaluation by a neurosurgeon or interventional neuroradiologist.

Appropriate treatment depends on the size and location of the aneurysm and other factors in the patient's medical history. Risk of rupture increases with the size of the aneurysm and time.

The most direct and common treatment for aneurysm, is to 'clip' it after opening the skull.

The most direct and common treatment performed, after opening the skull, is to 'clip' the aneurysm. The neurosurgeon uses microsurgical techniques to identify the 'neck' of the aneurysm, and by placing a small metal clip on the neck, prevents blood from entering the 'dome' of the aneurysm. These clips are designed to be left in place permanently, eliminating the risk of rupture.

Treatment of an aneurysm may be pos-

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sible without opening the skull, from the inside of the blood vessel itself. This treatment is called neuroendovascular therapy. Detachable coils are inserted into the aneurysm through a catheter that is threaded up into the artery. The coils slow the blood flow and help a clot form within the aneurysm. Neurosurgeons and neuroendovascular specialists work as a team to perform this procedure. An aneurysm that has bled once has a higher chance of bleeding again, usually with a dismal outcome.

It is important to note that aneurysm does not go away and, if immediate treatment has not been provided, it is essential that the patient stays in touch with his doctor to observe changes in the size and structure of the aneurysm.

An aneurysm is an abnormal bulging of the artery wall because of the weakness in the arterial wall. If an aneurysm ruptures, it will lead to collection of life-threatening blood clots in the brain. The new technique of coiling helps to treat brain aneurysms without surgery.

Vascular malformations

The term vascular malformation refers to an abnormal connection of an artery, vein or both. The malformation can be of normal veins (venous angioma) or arteries going directly to veins (arteriovenous malformations). These malformations are formed as the blood vessels of the brain develop in the foetal stage, but the actual cause is unknown. Neurosurgical treatment is recommended to prevent rupture.

Vascular malformations can be of normal veins or arteries going directly to the veins.

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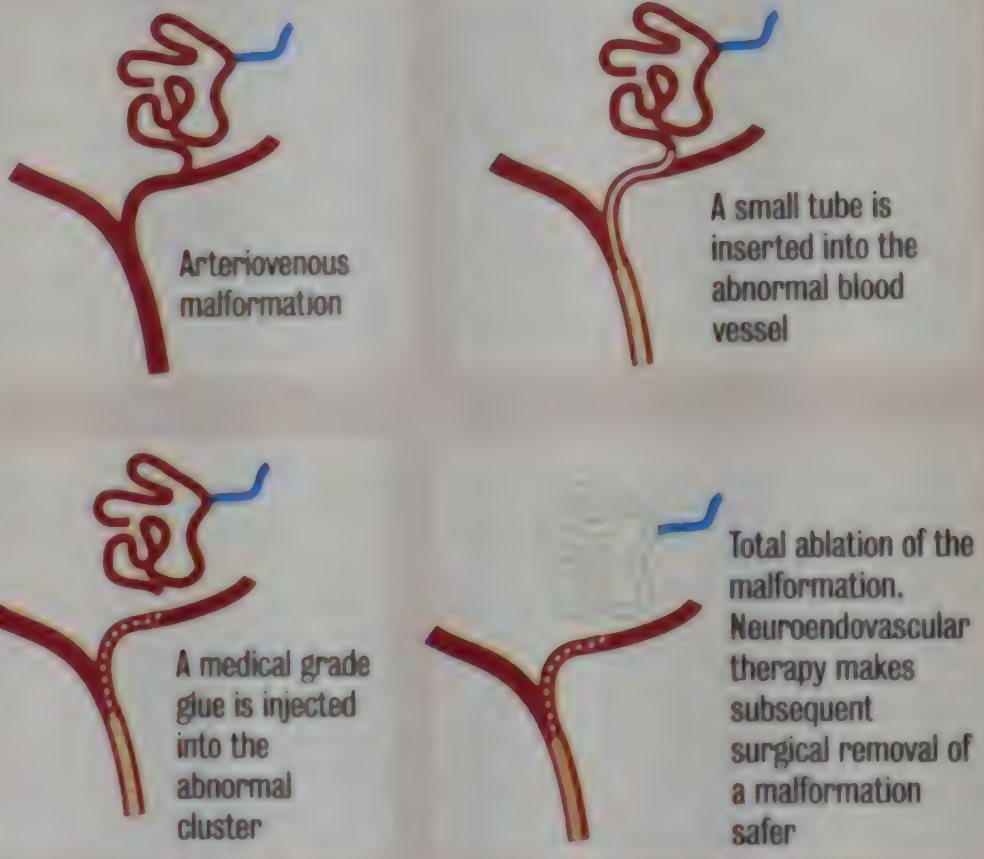
Arteriovenous malformations

Vascular malformations refer to an abnormal connection of an artery, vein or both. These form in the foetal stage and the direct cause is unknown.


Arteriovenous malformation
A small tube is inserted into the abnormal blood vessel
A medical grade glue is injected into the abnormal cluster
Total ablation of the malformation. Neuroendovascular therapy makes subsequent surgical removal of a malformation safer

Arteriovenous malformations (AVM) are usually diagnosed through a combination of MRI and angiography. AVM can irritate the surrounding brain and cause seizures or headaches. Left untreated, it can enlarge and rupture, causing an intracerebral or subarachnoid haemorrhage and permanent brain damage.

The three types of treatments available include direct removal using microsurgical

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techniques, stereotactic radiosurgery and embolisation using neuroendovascular techniques. Although AVM can be removed immediately through microsurgical treatment, some malformations may best be treated by a combination of therapies.

Although AVM can be removed with microsurgery, some malformations may best be treated by a combination of therapies.

Stereotactic radiosurgery is a minimally invasive treatment that uses computer guidance to concentrate radiation to the malformed vessels in the brain. This radiation causes abnormal vessels to close off. Unfortunately, stereotactic radiosurgery is usually limited to lesions less than 3.5 cm in diameter. It may take up to two years to completely obliterate the lesion and also has some long-term side effects.

Embolisation uses neuroendovascular techniques to guide tiny catheters to the brain that feed the AVM. Once the catheter reaches the core of the AVM, liquid and particulate embolic agents and microcoils can be injected to occlude portions of the malformation or its feeding arteries. Neuroendovascular therapy can make subsequent surgical removal of an AVM safer, or can reduce the size of an AVM so that radiosurgery or surgery can be safely performed with less risk and good results.

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Symptoms of stroke

The single most important factor in treating an acute stroke is time. Stroke is an emergency. Stroke victims need urgent medical care.

Symptoms of ischaemic stroke

◆ Visual disturbances, including blocked or loss of vision in one eye, blurry vision or 'graying'
"It seemed like someone was pulling a shade over one of my eyes."

◆ Weakness, numbness or clumsiness in one arm or hand or leg
"My arm wouldn't do what I wanted it to do."
"I couldn't hold on to my coffee cup."
"I couldn't lift up my arm/leg."
"My arm felt tingly."

◆ Language problems, including slurred speech
"I just couldn't say anything."
"She sounded drunk."
"My family couldn't make sense of what I was saying."

◆ Facial droop/weakness
"The left side of my face was sagging."

◆ Dizziness, stumbling
"I couldn't walk straight."

Symptoms of haemorrhagic stroke

◆ Severe or sudden headache
"I have the worst headache of my life."

◆ Loss of consciousness and/or vomiting

If there is any doubt whether you, or someone around you, is experiencing a stroke, seek immediate medical help.

Stroke can be caused by either a blockage in the arteries leading to the brain (an ischaemic stroke) or bleeding in the brain itself (a haemorrhagic stroke). There are two types of ischaemic stroke (thrombotic and embolic) and two types of haemorrhagic stroke (subarachnoid and intracerebral).

Treatment

Treatment of ischaemic stroke

A thrombotic stroke occurs when a build-up of plaque and blood clot, called a thrombus, blocks an artery to the brain and stops blood flow. An embolic stroke occurs when a piece of plaque or thrombus travels from its original site and causes a blockage downstream. The material that has moved is called an 'embolus'. How much of the brain is damaged or affected depends on exactly how far downstream in the artery the blockage occurs.

In most cases, the carotid or vertebral arteries do not become completely blocked and a trickle of blood does make its way to the brain. The reduced blood flow to the brain starves the cells of nutrients and quickly leads to the malfunctioning of the cells. As a part of the brain stops functioning, you feel symptoms of stroke. During stroke, there is a 'core'

Treatments such as tissue plasminogen activator should be given within three hours of the attack.

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area where blood is almost completely cut off and the cells die within 3-5 minutes. However, there is a much larger area known as the ischaemic penumbra that surrounds the core of dead cells. It consists of cells that are impaired and not functioning, but are not dead. These cells are called 'idling cells', and they can survive in this state for around three hours.

There are new treatments available to help rescue cells in this ischaemic penumbra. One such treatment is to stop permanent brain damage including drug therapy called tPA (tissue plasminogen activator). These therapies must be given within three hours of the onset of symptoms. However, before the drug therapies, a CT scan must be obtained to rule out any bleeding in the brain. This takes precious time. The sooner you get to the hospital, the better chance you have for a good outcome. All stroke victims must come in time to the hospital to make them eligible for this therapy which will make the difference be-

A patient's chances of complete recovery depends on how soon he gets medical help after an attack.

tween complete recovery and permanent disability.

Another significant advancement in acute stroke management has been the use of intra-arterial urokinase. This drug, which dissolves clot, is injected locally at the site of the clot using a catheter guided up the arterial tree through a small skin puncture under imaging guidance.

This technique is not only an efficient way to dissolve the block but has also increased the window from the previous three hours to six hours. The Kovai Medical Center has already established the safety and efficiency of this procedure for dissolving acute clots within six hours.

Treatment of haemorrhagic stroke

A haemorrhagic stroke can be caused by hypertension; rupture of an aneurysm or vascular malformation; reperfusion injury subsequent to an ischaemic stroke; or as a complication of anticoagulation medications. An intracerebral haemorrhage occurs when there is bleeding directly into the brain tissue, usually forming a clot within the brain. A subarachnoid haemorrhage occurs when the bleeding is into the cerebrospinal fluid spaces around the brain. Both conditions are very serious.

In some cases, neurosurgeons can use microsurgical or stereotactic techniques to remove the blood clot formed during an intracerebral haemorrhage. Medical and surgical management of intracranial pressure can also prevent permanent brain damage. Whatever be the treatment, it does appear that

A significant advancement in stroke management has been the use of intra-arterial urokinase.

patients who are evaluated and treated earlier fare better.

Patients experiencing subarachnoid haemorrhage require emergency medical treatment. Depending on the size and location of the aneurysm, microsurgical clips or neuroendovascular coils may be utilised. After treatment, SAH patients are monitored in intensive care for complications, including vasospasm and hydrocephalus.

Blood in the cerebrospinal fluid after SAH can lead to the spontaneous constriction of the arteries on the surface of the brain. This is called vasospasm. When vasospasm occurs, blood flow to the brain can be choked off by the constricting arteries, causing extensive strokes. SAH patients are at a risk of vasospasm for 4-14 days after rupture. Hydrocephalus is the build-up of cerebrospinal fluid in and around the brain. A subarachnoid haemorrhage can interfere with the normal absorption of the cerebrospinal fluid and cause hydrocephalus. Hydrocephalus usually progresses slowly over the months following a SAH and patients may complain of headache, drowsiness or other neurological problems. A CT scan can detect hydrocephalus and a neurosurgeon can treat this condition with a shunt to restore the proper drainage of cerebrospinal fluid from the brain.

Patients experiencing subarachnoid haemorrhage require emergency medical treatment.

Regardless of the type of stroke the patient has suffered, it is critical that victims receive medical treatment as soon as possible. By learning the signs and symptoms of stroke and getting treatment for the risk factors, you can help prevent it.

Conclusion

Stroke can be devastating. However, early management in hospitals with trained doctors and infrastructure can help overcome this crisis.

Stroke can be a result of block in the blood vessel. This can be reopened if a patient reaches the hospital within six hours

Stroke can be the result of bleeding from a ruptured blood vessel in the brain.

If this is secondary to a vascular malformation or aneurysm, they can be treated without surgery through the endovascular route, or by open surgery if necessary.

The key to minimising the complication of stroke is reaching the right hospital within the first six hours.

Early management in hospitals with trained doctors and infrastructure can help overcome this crisis.

K M
C H

Some advanced endovascular stroke management centres in India

DELHI
All India Institute of Medical Sciences, Ganga Ram Hospital, G.B. Pant Hospital, Indraprastha Apollo Hospitals, Vimhans

LUCKNOW
Sanjay Gandhi Postgraduate Institute of Medical Sciences

MUMBAI
K.E.M. Hospital, Bombay Hospital, Jaslok Hospital

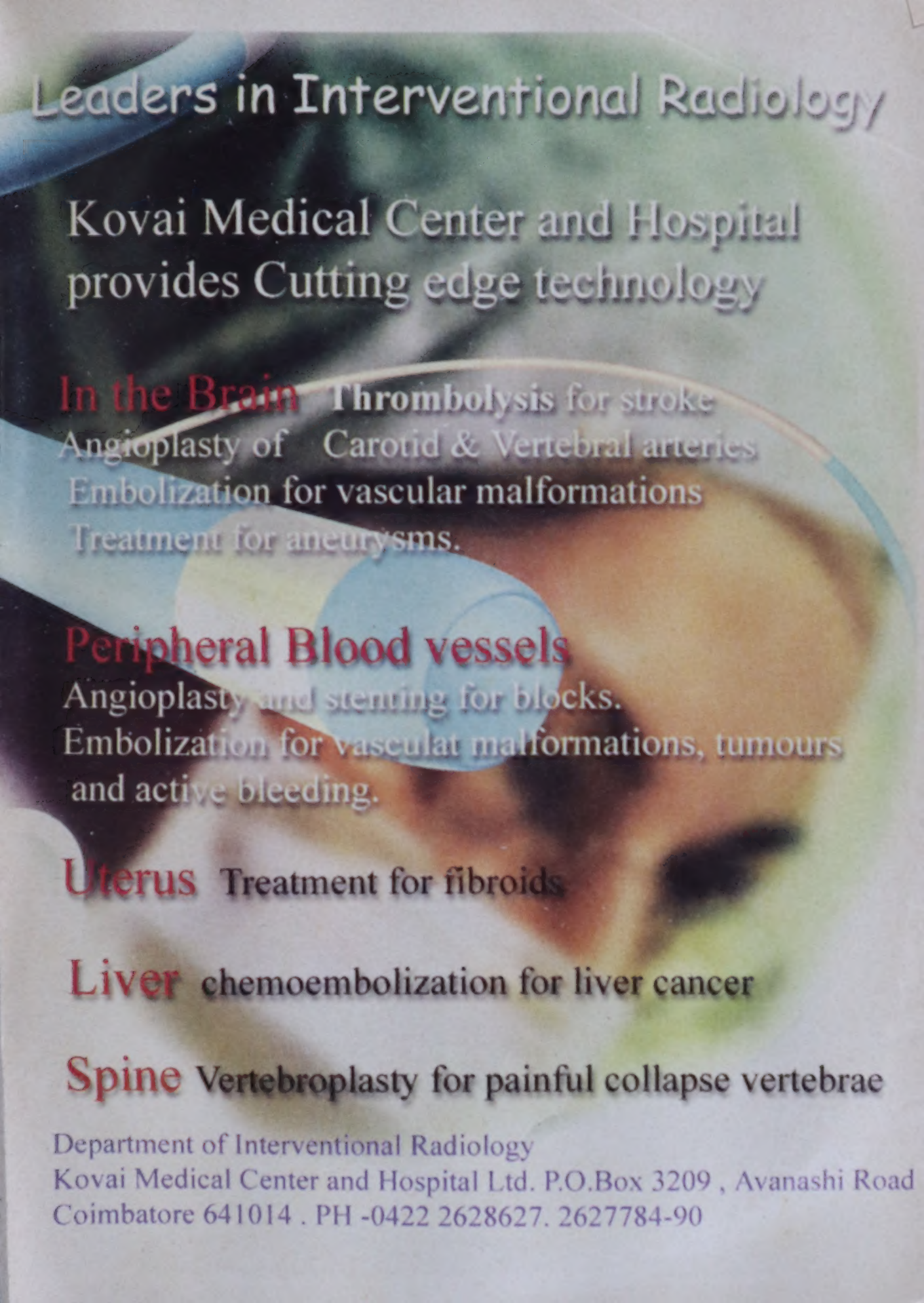
BANGALORE
National Institute of Mental Health and Neuro Sciences

CHENNAI
Sri Ramachandra Medical College

COIMBATORE
Kovai Medical Center and Hospital

THIRUVANANTHAPURAM
Sree Chitra Tirunal Institute for Medical Sciences and Technology

THE WEEK SUPPLEMENT
Published by Jacob Mathew from Kochi for the Malayala Manorama Co. Ltd., and printed by him at the Malayala Manorama Press, Kottayam. Chief Editor: Mammen Mathew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and active bleeding.
Uterus Treatment for fibroids
Liver chemoembolization for liver cancer
Spine Vertebroplasty for painful collapse vertebrae
Department of Interventional Radiology
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Interventional Radiology

Neurology & Neuro surgery

Orthopedic, Trauma and Joint replacements

Fertility Center & Andrology Clinic

Advanced Diagnostic Center & Hitech Laboratory

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